MODEL 2173A

SELECTIVE VOLTMETER

RYCOM

RAILWAY COMMUNICATIONS INC.

RAYTOWN, MISSOURI

SERIAL NO. _____

REPLACEMENT PARTS - see MAINTENANCE, Parts Ordering.

Changes special to this unit _____

_____

MODEL 2173A

SELECTIVE VOLTMETER

2173A-3 PARTS ADDENDUM

NOTE: This modification improves the dynamic range of the instrument, and improves the frequency stability.

Symbols appearing in both the deleted and added list differ in value or part number, but retain the same function.

The following are deleted.

C2	.22 uf	CR1	G703	R20	6.8 K
C3	6.8 uf	CR2	G703	R25	6.8 K
C14	.01 uf	L1	500 uh	R26	3.9 K
C35,64	47 pf N330	R1	120 K	R52	22 K
C37	47 pf NPO	R2	130 K		
C46,47	10 pf	R3	6.8 K		
C65	33 pf NPO	R7	1.5 K		

The following are added.

Symbol	Part No	M	Description
C14	SCM685BP035A4	AE	Cap. 6.8 uf 35 WVDC tantalum
C37		K	Cap. 100 pf 600 WVDC ±5% NPO ceramic (may be 2 at 47 pf)
C64		K	Cap. 47 pf 600 WVDC ±5% NPO ceramic*
C65	N330-K-220	O	Cap. 22 pf 600 WVDC ±5% N330 ceramic
C67	D2-105	Q	Cap. 1.0 uf 200 WVDC ±20% metalized paper
C68	GA-E9102M6	Q	Cap. .001 uf 600 WVDC ±20% disc
C69,70,72	GA-H1-KB18103V6	Q	Cap. .01 uf 600 WVDC GMV disc
C71	W1-505	N	Cap. 5.0 uf ±20% 100 WVDC metalized paper
C73	DM15E150J	M	Cap. 15 pf 500 WVDC ±5% SM*
CR1,CR2	MP-1	P	Diode, matched pair, silicon (may be 1N3605)
CR9	½M25Z	AI	Diode, zener, 25V ½W
L7	1500-15	AH	Coil, RF 500 uh
R2			Res. 2.2K 10% ½W
R3			Res. 120K 10% ½W
R7,R54			Res. 270Ω 10% ½W
R20			Res. 27K 10% ½W
R25,R26			Res. 1.6K 5% ½W
R52			Res. 10K 10% 1W
R55			Res. 3.9K 10% ½W
R56			Res. 10K 10% ½W
R57			Res. 15K 10% ½W
R58			Res. 160Ω 5% ½W
V12	6CW4	Y	Tube, nuvistor

AI Motorola

Note: For Serial No. 106--165 T1,2 & V4 are changed to R10,000 and 6BH6 per parts list for Serial No. 166 up.

*nominal-selected as required.

INSPECTION

This instrument has been thoroughly tested and inspected before shipment. The instrument should be inspected for damage as soon as it is received. If no damage is apparent, test for operation according to operating instructions in this manual.

SUMMARY

The Selective Voltmeter is a highly selective instrument for making voltage measurements of frequencies from 3 KC to 2 MC, varying in level from -90 to +32 dbm (30 volts maximum without external attenuation). Zero dbm reference is 1 milliwatt of power (or .775 volts) in a 600Ω load. The input signal is attenuated to the proper value by the attenuator, amplified and demodulated to 2215 KC by a shunt type demodulator and variable oscillator. This 2215 KC signal passes through a sharp crystal filter, then is amplified and detected. The dc output is applied to a 200 microampere meter. The meter has dbm and voltage scales and is calibrated to indicate the signal level at the instrument's input connector.

A wide crystal filter or broad tuning may be selected for monitoring. In this use the 2215 KC amplifier output is demodulated by a shunt type demodulator and crystal oscillator for upper or lower sidebands, by a conventional diode detector for AM signals, or by slope detection of FM signals. The monitor output is to a speaker or headset jack. An internal calibrating circuit is provided so calibration can be made or checked as desired.

INSPECTION

This instrument has been thoroughly tested and inspected before shipment.

The instrument should be inspected for damage as soon as it is received.

If no damage is apparent, test for operation according to operating instruc-

tions in this manual.

SUMMARY

The Selective Voltmeter is a highly selective instrument for making voltage

measurements of frequencies from 3 KC to 2 MC, varying in level from -90

to +52 dbm (30 volts maximum without external attenuation). Zero dbm ref-

erence is 1 milliwatt of power (or .775 volts) in a 600Ω load. The input

signal is attenuated to the proper value by the attenuator, amplified and

demodulated to 221.5 KC by a shunt type demodulator and variable oscillator.

This 221.5 KC signal passes through a sharp crystal filter, then is amplified

and detected. The dc output is applied to a 200 microampere meter. The

meter has dbm and voltage scales and is calibrated to indicate the signal

level at the instrument's input connector.

A wide crystal filter or broad tuning may be selected for monitoring. In

this use the 221.5 KC amplifier output is demodulated by a shunt type demod-

ulator and crystal oscillator for upper or lower sidebands, by a conven-

tional diode detector for AM signals, or by slope detection of FM signals.

The monitor output is to a speaker or headset jack. An internal calibrating

circuit is provided so calibration can be made or checked as desired.

DESCRIPTION

The input circuit contains a condenser (C1) to block dc potentials, and an attenuator. The ATTENUATOR properly adjusts the input signal applied to V1 and has a CAL position used in calibrating the instrument. The isolation amplifier (V1) feeds a shunt type balanced demodulator (CR1 and CR2). A variable frequency LC oscillator (V3) and paraphase amplifier (V2) supplies carrier frequency for demodulation. This frequency is controlled by the main tuning condenser (C49) and BAND SEL switch (S3). The 250 cps or 2.8 KC crystal filters or the normal IF coupling passes the lower sideband of demodulation. The 2215 KC IF amplifiers (V4 & V5) feeds both the measure (V6,CR5 & CR6) and monitor sections (V8-9-10) of the instrument. The IF amplifier gain is adjusted by CAL 2 LEV (R101). The meter circuit amplifier (V6) feeds a series shunt type meter rectifier (CR5-6) whose output indicates on a 200 microampere meter calibrated in dbm and volts.

The amplifier (V8) feeds a shunt type demodulator (CR3 & CR4) for monitoring lower sideband (LSB) or upper sideband (USB) signals. The carrier for this demodulator is supplied by a crystal controlled oscillator (V9B). For monitoring amplitude modulated signals or slope detection of FM signals, this oscillator is made inoperative and diode CR4 removed, thus the circuit operates as a conventional series diode detector. The resulting audio signal passes through the RC filter (R15-16 & C20-21) and amplifier (V9A & V10) to the speaker or a headset plugged into the HEADSET jack (J3). The audio output amplitude is controlled by MON LEV (R102).

An audio signal may be amplified by inserting it in the AUDIO IN jack just ahead of the audio amplifier (V9A & V10).

A self contained 100 KC crystal controlled calibration oscillator (V7A) is coupled to a cathode follower (V7B) whose output level is adjusted by the

potentiometer CAL 1 LEV (R104). Plate power is supplied to the calibrate oscillator only when the BAND SEL switch is in the CAL position, thus it is in operation only during calibration.

Plate power is furnished by a bridge type full wave selenium rectifier (CR7). A voltage regulator tube (V11) stabilizes the plate supply to all circuits except the monitor section.

The filaments are 30 volts dc above ground (R45-48 & C60-61) to prevent heater to cathode leakage and to lower 60 cps modulation which may occur in V1,V2 and V3.

INPUT

The input is an unbalanced high impedance circuit with a BNC connector (J1) provided for connection to the signal source.

ATTENUATOR

The attenuator provides 0 to 100 db of attenuation for measuring signals between -68 and +32 dbm (full scale meter indication).

The CAL position is connected to the voltage divider of the calibrate oscillator output for calibrating the isolation and IF amplifiers.

FREQUENCY

The local oscillator is varied from 2218 KC to 4215 KC by BAND SEL switch and the main tuning dial to measure frequencies of 3 KC to 2 MC respectively as indicated on the frequency dial. For example, a frequency of 100 KC is fed into the instrument. The BAND SEL switch is set on band A and the frequency dial pointer is tuned to 100 KC. The main oscillator is now operating at 2315 KC and the lower sideband of demodulation is 2215 KC which is the center frequency of the crystal filter. This is amplified by the IF and meter amplifiers and indicated on the meter, or is detected in the monitor section producing a tone in the speaker or headset.

A 100 KC crystal controlled oscillator is provided for frequency calibration of the local oscillator. This is an internal adjustment and the procedure for calibrating is in the MAINTENANCE SECTION.

SELECTIVITY

The SELECTIVITY switch is used to select one of three filters at the balanced demodulator output. The position marked 250 ~ is used for measuring. The position 2.8 KC selects a filter of appropriate width for 3 or 4 KC single sideband voice channels.

The position marked IF selects a coupling network to the IF amplifier whose transformers determine the bandwidth of this position. This position is used in monitoring amplitude modulated and frequency modulated voice channels or signals. The response curves are in the back of the book.

MONITOR

The control marked MONITOR is an ON-OFF switch for the AC power to the instrument and the gain control of the audio amplifier of the monitor section. The LSB position of the MONITOR switch connects a 2216.5 KC crystal to the monitor oscillator for demodulating lower sideband signals. The USB position connects a 2213.5 KC crystal to the oscillator for demodulating upper sideband signals. The AM position disconnects the plate power to the oscillator and disconnects diode CR4 thus converting the shunt type demodulator to a single series diode detector.

METER

The METER switch (S5) controls the input to the meter circuit (V6, CR5 & CR6). The OFF position shorts the meter input terminals to prevent pinning the needle while monitoring weak signals. The ON position connects the IF amplifier output to the meter circuit for measuring and for the second step of calibration.

The CAL 1 position connects the calibrate oscillator output to the meter for the first step of calibration.

CALIBRATION

BASIC CALIBRATION: Basic calibration adjusts a precision voltage divider (R35,36,37 & R105 and attenuator CAL position) to give a correct meter indication using an accurate external source as a standard. This adjustment is made at the factory. It can be checked and re-adjusted if necessary, as given in the MAINTENANCE SECTION.

INTERNAL CALIBRATION: Internal calibration calibrates the isolation amplifier and IF stage using the precision voltage divider as a standard. This calibration is made as a part of the normal operation of the instrument. Internal calibration uses the self contained calibration oscillator and is accomplished in two steps. Detailed step-by-step procedure is given in the OPERATING INSTRUCTIONS.

OPERATING INSTRUCTIONS

GENERAL

Operation of the Selective Voltmeter is divided into two major functions, that of measuring signals as indicated by the meter and that of monitoring carrier and audio voice bands or signals.

All controls, signal input, audio input and output jacks, and power connections are on the front panel of the portable instrument. Input, output and power connections may be on the back of the rack-mounted instrument.

The power required is 48 watts 50 to 400 cps, 115 volts. Connection is made to the instrument with the cord furnished in the receptacle (AC). The power switch is located on the MONITOR LEVEL control where the OFF position is indicated (AC OFF).

INTERNAL CALIBRATION

Calibrate the instrument as follows for direct reading in dbm.

CAL 1

1. Switch positions.
   Meter to Cal 1, Attenuator to Cal, Band Selector to Cal.
2. Adjust Cal 1 level to give zero on meter db scale for a 600~ circuit.

CAL 2

1. Switch positions.
   Meter ON, Attenuator to Cal, Band Selector to Cal, Selectivity to 250 ~, Monitor to AM.
2. Move pointer to 100 KC on Band A.
3. Adjust Cal 2 trim for peak reading on meter.
4. Adjust Cal 2 level for zero reading on meter.

This completes the calibration and the instrument is ready for use.

FREQUENCY SELECTION

Frequency selection is made by means of the Band Selector, Frequency and Selectivity controls. The frequency to be measured is tuned in by the large center knob and the position of the band selector switch.

The selectivity switch selects the filter band width to be used. Use the 250 ~ position for precise measurements and the 2.8 KC and IF position for monitoring. The IF position may be used above 100 KC.

AMPLITUDE MEASUREMENT

Connect the signal to be measured to the BNC input connector. (CAUTION: see overload paragraph).

1. Switch positions.
   Meter ON, Attenuator to proper level, Selectivity to 250 cycles, Band Selector to desired band, Monitor to AM.
2. Adjust frequency dial pointer to desired frequency and for maximum meter indication.
3. Add meter indication and attenuator position algebraically to obtain amplitude of signal being measured.

LOW FREQUENCY MEASUREMENTS

Measurements below 5 KC to about 1 KC require certain precautions. The selectivity switch must be in 250 ~ position below 5 KC.

OVERLOAD

The amplifiers of this instrument overload before the meter movement is damaged on moderate overload----however, excessive or prolonged overloads should be avoided.

Amplitudes of +20 dbm or higher should not be left applied to the instrument for longer than a minute or two, since the input circuit may heat. If a +20

dbm or higher amplitude is to be connected continuously, a suitable pad should be connected ahead of the instrument to reduce the level below +20 dbm.

LOW AMPLITUDE SIGNALS IN PRESENCE OF HIGH AMPLITUDE SIGNALS

Overloading is reduced by introducing attenuation to the input signals. Therefore, when measuring a low level signal when high level signals are present, the more accurate reading will be made when the attenuator step is selected to give a meter reading on the lower 10 db section of the meter scale. When measuring circuits on which the amplitudes are not approximately known, it is suggested that the entire spectrum be first scanned to determine the highest amplitude signals present. This will indicate the lowest level signals which may be accurately measured. When highest to lowest levels exceed 45 db, some inaccuracy due to overload or intermodulation may be suspected. In any case, when a low level signal is being measured, if the attenuator switch is changed by 10 db and the meter reading also changes 10 db, the measurement can be considered accurate.

When many signals are present, no simple rule can be followed, as the overload point is determined by the peak envelope of the combined signals.

CARRIER MONITORING

The Selective Voltmeter may be used to monitor lower sideband (LSB), upper sideband (USB), amplitude modulated (AM), or frequency modulated (FM) signals. Use the 2.8 KC monitor of selectivity switch above 5 KC only and IF position above 100 KC only.

1. Upper and lower sideband monitoring.
   a. Connect the circuit to be monitored to the input jack.
   b. Switch positions.
      Selectivity to 2.8 KC.
      Band Selector switch to proper band.

Frequency dial pointer to midband frequency of the sideband.

Monitor switch to LSB or USB as required.

Monitor Level, adjust as required.

If the signal from the speaker or headset is weak, turn the meter switch OFF and the attenuator down until the desired level is reached.

2. AM Monitoring.
To monitor AM signals, feed the signal in the input connector, turn the selectivity to 2.8 KC or IF, set the monitor switch to AM, tune the frequency dial to the carrier frequency and adjust the amplitude as for single sideband signals.

3. FM Monitoring.
To monitor FM signals by slope detection, feed the signal in the input connector, turn the selectivity switch to IF, set the monitor switch to AM, adjust the frequency dial for best reception (one side of the selectivity curve) and adjust the amplitude as for single sideband signals.

AUDIO MONITORING

The audio section of the monitor circuit may be used as a voice frequency amplifier if desired by inserting the signal in the audio IN jack. The output amplitude is controlled by the Monitor Level control.

MAINTENANCE

GENERAL

Most of the components used in the construction of RYCOM instruments are standard parts obtainable from local suppliers. Precision components may be purchased from the manufacturer. Special items may not be readily available from the manufacturer. All replacement parts are available from RYCOM. For various reasons, changes will occasionally appear in the instruction book text, parts list and drawings. Continued effort is being made to improve circuitry and use better components. During the test procedure, individual adjustments are made to obtain optimum operation. Parts procurement difficulties occasionally require substitution of different but equivalent parts. Normal maintenance involves replacement of tubes, fuse and pilot lights. The frequency dial lights are accessible from the front by removing the knob and black dial cover. When replacing the frequency knob, lock the knob on the vernier shaft so that it will clear the screw heads when pressed down in direct drive position.

To remove the instrument from the case for maintenance, remove only the screws around the edge of the front panel.

PARTS ORDERING

When ordering parts be sure to specify the instrument serial number as well as the instrument model number and individual part number and symbol. This will insure receiving the correct replacement parts with a minimum of delay.

BASIC AMPLITUDE CALIBRATION

Tube replacement or aging may cause some error in meter indication which is not expected to be more than ±1/2 db. This can be corrected by basic re-calibration of the instrument as discussed in CALIBRATION paragraph of the description and given in step form on the next page.

1st step

a. Connect an external signal of about 100 KC at 0 dbm amplitude to the input connector (Note: use a precision meter to determine the 0 dbm amplitude).

b. Switch positions.
ATTENUATOR at 0

METER to ON

SELECTIVITY to 250 ~

MONITOR to AM

BAND SEL to A

FREQUENCY dial to give peak indication on meter.

c. Adjust CAL 2 LEV to give 0 db on meter.

2nd step

a. Caution: Do not change CAL 2 LEV

b. Switch positions
METER to CAL 1

BAND SEL to CAL

c. Adjust CAL 1 LEV to give 0 db on meter

3rd step

a. CAUTION: Do not change CAL 2 LEV or CAL 1 LEV

b. Switch positions
METER to ON

ATTENUATOR to CAL

SELECTIVITY to 250 ~

MONITOR to AM

BAND SEL to CAL

c. Adjust CAL 2 TRIM for peak meter indication.

d. Adjust CAL 3 control located on top of chassis behind the meter to give 0 db on the meter.

FREQUENCY CALIBRATION

Frequency recalibration is made each time CAL 2 TRIM control is adjusted for peak meter indication during calibration, however, if the frequency tuning drifts more than ±1 KC it may be desirable to recalibrate all frequency bands. If CAL 2 TRIM gives a peak indication at either extreme of rotation (when planetary drive slips), the oscillator in CAL position has drifted out of the range of the control and the CAL position should be recalibrated. Follow calibration procedure below very carefully.

An accurate 1 KC to 2 MC signal generator and counter will be required to recalibrate the frequency dial (Local Osc).

Remove the case, turn on the power and allow the instrument to warm up for 20 minutes. Connect the external oscillator to the INPUT jack. Set the CAL 2 TRIM control two turns from either limit. Set the attenuator control to level used, BAND SEL and frequency dial to position indicated in the chart below. Adjust the trimmer indicated in the chart to obtain a peak meter indication.

ATTN	BAND SEL	FREQ DIAL	ADJUST TRIMMER
Level used	F	1.6 MC	F
Level used	E	1.0 MC	E
Level used	D	700 KC	D
Level used	C	450 KC	C
Level used	B	250 KC	B
Level used	A	100 KC	A
CAL	CAL	100 KC	A

The capacitors in the main oscillator are accumulatively added to the circuit as the BAND SEL switch is rotated from F to CAL, thus frequency calibration must be made in the order listed above.

IF STAGE RETUNING

In the event CAL 2 LEV amplitude cannot be turned high enough to calibrate the instrument, tube replacement and retuning of the IF stages will be necessary.

Connect a signal of about 100 KC to the INPUT jack (J1). Tune in the signal and adjust front panel controls for maximum meter indication with SELECTIVITY switch on 250 ~. Rotate the top and bottom slugs of T1 and T2 for maximum meter indication.

CRYSTAL FILTER RETUNING

A sweep frequency generator and dc coupled oscilloscope are required for proper crystal filter retuning. These are special units and not normally available, thus it is recommended that the instrument be returned to the factory if the crystal filter needs retuning.

If equipment as described below is available and it is desired to retune the crystal filter, write the factory for instructions.

1. A sweep frequency generator with center frequency variable from 10 to 500 KC and sweep width adjustable from about 500 cps to 30 KC. It should have a repetition rate of about 0.1 cycles per second and output amplitude variable from a few microvolts to approximately 0.1 volt.

2. A direct coupled oscilloscope with a long persistence screen.

LIST OF MANUFACTURERS

Symbol is listed in parts list under manufacturer.

Symbol	Manufacturer
A	Alden Products Company
B	All Star Products Inc
C	Allen-Bradley Company
D	Amphenol
E	Blackhawk Engineering
F	Bussman Mfg Company
G	Chicago Miniature Lamp Works
H	Cornell-Dubilier
I	CTS Corporation
J	Dickson Electronics Corp
K	Dilectron Inc
L	E.F. Johnson Company
M	Electro Motive Mfg Company
N	Electron Products Company
O	Erie Resistor Corporation
P	General Electric Company
Q	Good-All Electric Mfg Co
R	Grigsby Company
S	International Rectifier Corp
T	Itek Electro Products Co
U	Kidco Inc
V	National Transistor Mfg Inc
W	Ohmite Mfg Company
X	Pace Electrical Instrument Co
Y	Radio Corporation of America
Z	Railway Communications Inc
AA	Sherold Crystal Corporation
AB	Stanwyck Winding Company
AC	Switchcraft Inc
AD	Sylvania Electric Products Inc
AE	Texas Instruments
AF	Transformer Technicians Inc
AG	Utah Radio Products Corp
AH	Wilco Corporation

List of abbreviations in parts list.

A	Linear taper
AR	Selected as required
DC	Deposited carbon
DISC	Disc ceramic
S	Shaft (meas from end of bushing)
SD	Screwdriver shaft
WW	Wire wound
SM	Silver mica
VAR	Variable

PARTS LIST (Use this page for Ser. No. 106 - up)

Symbol	Part No	M	Description
AC OFF			Part of R102
AT	2173-A3	Z	Attenuator, 100 db, 10 steps plus CAL pos
CR1,CR2	C01	AE	Diode, Germanium (Ser. 106 - 148)
CR1,CR2	G703	V	Diode, Germanium (Ser. 149 - up)
CR3,CR4			
CR5,CR6	1N34A	AD,W	Diode, Germanium
CR7	61-4037	S	Rectifier, selenium 100 ma
CR8	3/4Z50D	J	Diode, zener 50 volt (Ser. 131 - up)
DS1,DS2	Type 47	G	Lamp (in freq tuning assy)
F1	AGC1	F	1 amp fuse in HKP fuse holder
FL1	2215KB	T	Filter, crystal 250 cycles (Ser. 106 - 130)
FL1	2215SB	E	Filter, crystal 250 cycles (Ser. 131 - up)
FL2	2215KA	T	Filter, crystal 2.8 KC (Ser. 106 - 130)
FL2	2215SA	E	Filter, crystal 2.8 KC (Ser. 131 - up)
J1	UG657/U	D	Connector, receptacle electrical
J2,J3	12A	AC	Jack
J4	902PMTH	A	Connector, receptacle electrical
L1,L4	1500-15	AH	Coil, RF 500 uh
L2	3063-15	AH	Coil, RF 63 uh
L3	3080-15	AH	Coil, RF 80 uh
L5	2366-3	Z	Coil, local osc
L6	3133	AF	Coil, 7 hy
L7	3150-15	AH	Coil, RF 150 (or 180 uh when required) (Ser. 131 - 148 only)
LS1	V35A47	AG	Speaker, $3\frac{1}{2}$"
M	GD-192	X	Meter, 0-200 DC ua special scale, 800Ω
S2	74A-S2A	Z	Switch, rotary 2 deck 1 pole 3 position
S3	74A-S3	Z	Switch, rotary 2 deck 1 pole 7 position
S4	74A-S4,5	Z	Switch, rotary 3 pole 3 position
S5	24460-4MLR-1	R	Switch, rotary 1 deck 2 pole 3 position
T1,T2	R8180-B	AB	Transformer, IF (Ser. 106 - 165)
T1,T2	R10,000	AB	Transformer, 2215 KC IF (Ser. 166 - up)
T3	R8180-B	AB	Transformer, IF
T4	3134	AF	Transformer, output
T5	3135	AF	Transformer, power
V1	6CW4	Y	Tube, nuvistor
V3	12AU7A		Tube, electron (Ser. 106 - 130)
V2,V3	6CW4	Y	Tube, nuvistor (Ser. 131 - up)
V4	6CB6A		Tube, electron (Ser. 106 - 165)
V4	6661/6BH6	P	Tube, electron (Ser. 166 - up)
V5	6BJ6		Tube, electron
V6,V8	6661/6BH6	P	Tube, electron (or 6BH6)

PARTS LIST (Use this page for Ser. No. 106 - up)

Symbol	Part No	M	Description
V7,V9	12AU7A		Tube, electron
V10	6AQ5A		Tube, electron
V11	0A2		Tube, electron
-	3024	Z	Tun drive assy ratio 12 to 1 (Ser. 106 - 130)
	3024-3	Z	Tun drive assy ratio 12 or 48 to 1 (Ser. 131 - up)
WA	202F1AC	A	Cord, line
Y1	SC-9-100KC	AA	Crystal, 100.000 KC
Y2	SC-6-2213.5KC	AA	Crystal, 2213.50 KC
Y3	SC-6-2216.5KC	AA	Crystal, 2216.50 KC

PARTS LIST (Use this page for Ser. No. 106 - 130)

Symbol	PART NO	M	Description
			CAPACITORS
C1,C2	W4-224	N	.22 uf 400 WVDC ±20% metalized paper
C3	SCM685BP035A4	AE	6.8 uf 35 WVDC ±20% tantalum
C4,C53,C56	GA-H1-KB25503V6		.05 uf 600 WVDC GMV DISC
C5	D2-105	N	1.0 uf 200 WVDC ±20% metalized paper
C6,C7,C10			
C11	0557051-U2P0-34R	O	8-50 pf N750 ceramic trimmer
C8,C9	DM15E270J	M	27 pf 500 WVDC ±5% P40 SM
C12,C13,C14			
C15,C16,C18			
C24,C25,C27			
C29,C30,C31			
C33,C54,C55			
C57,C58	GA-H1-KB18103V6	Q	.01 uf 600 WVDC GMV DISC class 2
C17,C22,C50	GA-E9102M6	Q	.001 uf 600 WVDC ±20% disc
C19	DM15E361J	M	360 pf 500 WVDC ±5% P40 SM
C20,C21,C51	DM19E501J	M	500 pf 500 WVDC ±5% P40 SM
C23	DM15E470J	M	47 pf 500 WVDC ±5% P40 SM
C26	GA-H1-KB10302V6	Q	.003 uf 600 WVDC GMV DISC
C28	UPE4445C	H	40-40-20 uf, 450-450-25 WVDC dry electro'c
C32,C59			
C60,C61	GA-63010402W	Q	.1 uf 200 WVDC ±20% mylar
C34,C35			
C37,C39			
C41	DM15E101J	M	100 pf 500 WVDC ±5% P40 SM
C36,C38			
C40,C42			
C44	0503001-C0P0-37R	O	4.5-25 pf NP0 ceramic trimmer
C43,C45	DM15E111J	M	110 pf 500 WVDC ±5% P40 SM
C46	SPEC 4197	B	4-10 pf air trimmer 4-turn
C47			235 pf composed of the following:
	GAA22C151+5J6	Q	155 pf 600 WVDC ±5% N080 DISC
	DM15E330J	M	33 pf 500 WVDC ±5% P40 SM
	DM15E470J	M	47 pf 500 WVDC ±5% P40 SM
C48	0557006-C0P0-39R	O	5-25 pf NP0 ceramic trimmer
C49	167-153-5	L	12-150 pf air variable (mtg bkts removed)
C52	DM15E050J	M	5 pf 500 WVDC ±5% P40 SM

PARTS LIST (Use this page for Ser. No. 131 - up)

Symbol	PART NO	M	Description
			CAPACITORS
C1,C2	W4-224	N	.22 uf 400 WVDC ±20% metalized paper
C3	SCM685BP035A4	AE	6.8 uf 35 WVDC ±20% tantalum
C4,C12-C16, C18,C24,C25 C27,C29,C30 C31,C33,C53- C58	GA-H1-KB18103V6	Q	.01 uf 600 WVDC GMV DISC class 2
C5 C6,C7	D2-105	N	1.0 uf 200 WVDC ±20% metalized paper
C10,C11	0557051-U2P0-34R 0		8-50 pf N750 ceramic trimmer
C8,C9 C17,C22	DM15E270J	M	27 pf 500 WVDC ±5% P40 SM
C32	GA-E9102M6	Q	.001 uf 600 WVDC ±20% DISC
C19 C20,C21	DM15E361J	M	360 pf 500 WVDC ±5% P40 SM
C51	DM19E501J	M	500 pf 500 WVDC ±5% P40 SM
C23	DM15E470J	M	47 pf 500 WVDC ±5% P40 SM
C26	GA-H1-KB10302V6	Q	.003 uf 600 WVDC GMV DISC
C28	UPE-4445C	H	40-40-20 uf, 450-450-450-25 WVDC dry electrolytic
C34,C62	DM15E101J	M	100 pf 500 WVDC ±5% P40 SM
C35,C64 C36,C38 C40,C42		K	47 pf 600 WVDC ±5% N330 DISC
C44,C48	0503001-C0P0-37R 0		4.5-25 pf NP0 ceramic trimmer
C37 C39,C41		K	47 pf 600 WVDC ±5% NP0 DISC
C43,C45		K	100 pf 600 WVDC ±5% NP0 DISC
C46,C47		K	10 pf 600 WVDC ±5% N750 DISC
C49	167-153-5	L	12-150 pf air variable (mtg bkts removed)
C50	DM19E102J	M	1000 pf 500 WVDC ±5% P40 SM
C52 C59,C60	DM15E050J	M	5 pf 500 WVDC ±5% P40 SM
C61	GA-63010402W	Q	.1 uf 200 WVDC ±20% mylar
C63	SPEC4197	B	4 to 10 pf air trimmer 4-turn
C65		K	33 pf 600 WVDC ±5% NP0 DISC
C66	GA-A22C151+5J6	Q	155 pf 600 WVDC ±5% N080 DISC

PARTS LIST (Use this page for Ser. No. 106 - up)

SYMBOL	PART NO	M	Description
			RESISTORS
R1,R27			
R32,R40		C	120K 10% ½W
R2		C	130Ω 5% ½W
R3,R8,R10			
R20,R33		C	6.8K 10% ½W
R4		C	18K 10% ½W
R5,R6		C	3.9K 10% ½W
R7		C	270Ω 10% ½W (Ser. 106 - 165)
R7		C	1.5K 10% ½W (Ser. 166 - up)
R9		C	270Ω 10% ½W
R11,R22		C	2K 5% ½W
R12,R13		C	13K 5% ½W
R14		C	68K 10% ½W
R15,R17,R19			
R29,R30		C	27K 10% ½W
R16,R18,R21			
R23,R31,R46		C	100K 10% ½W
R24		C	820Ω 10% 2W
R25,R26		C	4.7K 10% ½W (Ser. 106 - 130)
R25		C	6.8K 10% ½W (Ser. 131 - up)
R26		C	3.9K 10% ½W (Ser. 131 - up)
R28		C	100K 10% ½W (Ser. 106 - 130)
R28		C	27K 10% ½W (Ser. 131 - up)
R34, R36		C	2.2K 10% ½W
R35		U	487Ω 1% ½W DC
R37		U	100Ω 1% ½W DC
R38		C	560Ω 10% ½W
R39		C	47K 10% ½W
R41		C	8.2K 10% ½W
R42		U	10K 1% ½W DC
R43		U	3.57K 1% ½W DC
R44		W	1.1K 10% 10W WW
R45		C	100K 10% ½W (Ser. 106 - 131)
R45		C	470K 10% ½W (Ser. 131 - up)
R47,R48		C	220Ω 10% ½W
R51		C	110Ω 5% ½W (Ser. 131 - up)
R52		C	22K 10% 1W (Ser. 131 - up)
R49,R50		U	10K 1% ½W DC (Ser. 131 - 148)
R49,R50		U	487Ω 1% ½W DC (Ser. 149 - up)
R101,R104	JF7539	I	5K 30% ½W VAR. A,3/8 S
R102	KS9156	I	250K 30% ½W VAR. A,3/8 S, W/SPST SW. 3 AMP 125V
R103	KL7097		20K 30% ½W VAR. A,13/16 S, 10 turn (Ser. 106 - 130)
R105	JF7540	I	5K 30% ½W VAR. A, SD
R53		C	2K 5% ½W (Ser. 131 - up)

HIGH FREQUENCY SELECTIVE VOLTMETER

WAVE ANALYZER

MODEL 2173A

SPECIFICATIONS

FREQUENCY RANGE: 3 kilocycles to 2.0 megacycles.

LEVEL: −72 to +32 dbm (full scale).

ACCURACY: ±1 db. −80 to +32 dbm.

SELECTIVITY: 250 cycles
2800 cycles
Wide band (normal IF)

SPURIOUS RESPONSE: Below 60 db.

INTERMODULATION: Below 60 db.

INTERNAL CRYSTAL CALIBRATION for frequency and level. Speaker or headset for aural monitoring.

POWER REQUIREMENTS: 110V AC 50/60 cycles.

WEIGHT: 28 pounds. Portable unit.

The Model 2173A Frequency Selective Voltmeter is an extremely versatile instrument for measuring levels of carrier and subcarrier microwave base band groups. For full information and demonstration, call your nearest Rycom representative or phone: Code #816 — FLeming 3-2100.

A Division of

RYCOM®
INSTRUMENTS

RAILWAY COMMUNICATIONS, INC.
9351 E. 59TH STREET, RAYTOWN, MISSOURI
Phone: Code #816—FLeming 3-2100

THERE'S A MODEL *in stock* FOR YOUR NEEDS

RYCOM MODEL 2171A
SPECIFICATIONS

FREQUENCY RANGE: 50 cycles to 6 kilocycles.
SELECTIVITY: 30 cycle or 50 cycle filter.
LEVEL FULL SCALE: −72 to +32 dbm.
ACCURACY: ±.5 db −80 to +32 dbm. 50 cycles to 6 kilocycles.
SPURIOUS RESPONSE: Below 60 db.
LOW INTERMODULATION: Below 60 db.
POWER REQUIREMENTS: 115V AC 50/60 cycles.
WEIGHT: 28 pounds.

RYCOM MODEL 2174A
SPECIFICATIONS

FREQUENCY RANGE: 300 cycles to 400 kilocycles.
SELECTIVITY: 100 cycle 3 kilocycle and 10 kilocycle filters.
LEVEL FULL SCALE: −72 to +32 dbm.
ACCURACY: ±.5 db −80 to +32 dbm. 300 cycles to 400 kilocycles.
SPURIOUS RESPONSE: Below 60 db.
LOW INTERMODULATION: Below 60 db.
POWER REQUIREMENTS: 115V AC 50/60 cycles.
WEIGHT: 28 pounds.

**Model 2174A supplied with a 50 cycle filter at a slight increase in cost.*

Submit your requirements for special deviations from above instruments . . . . . .

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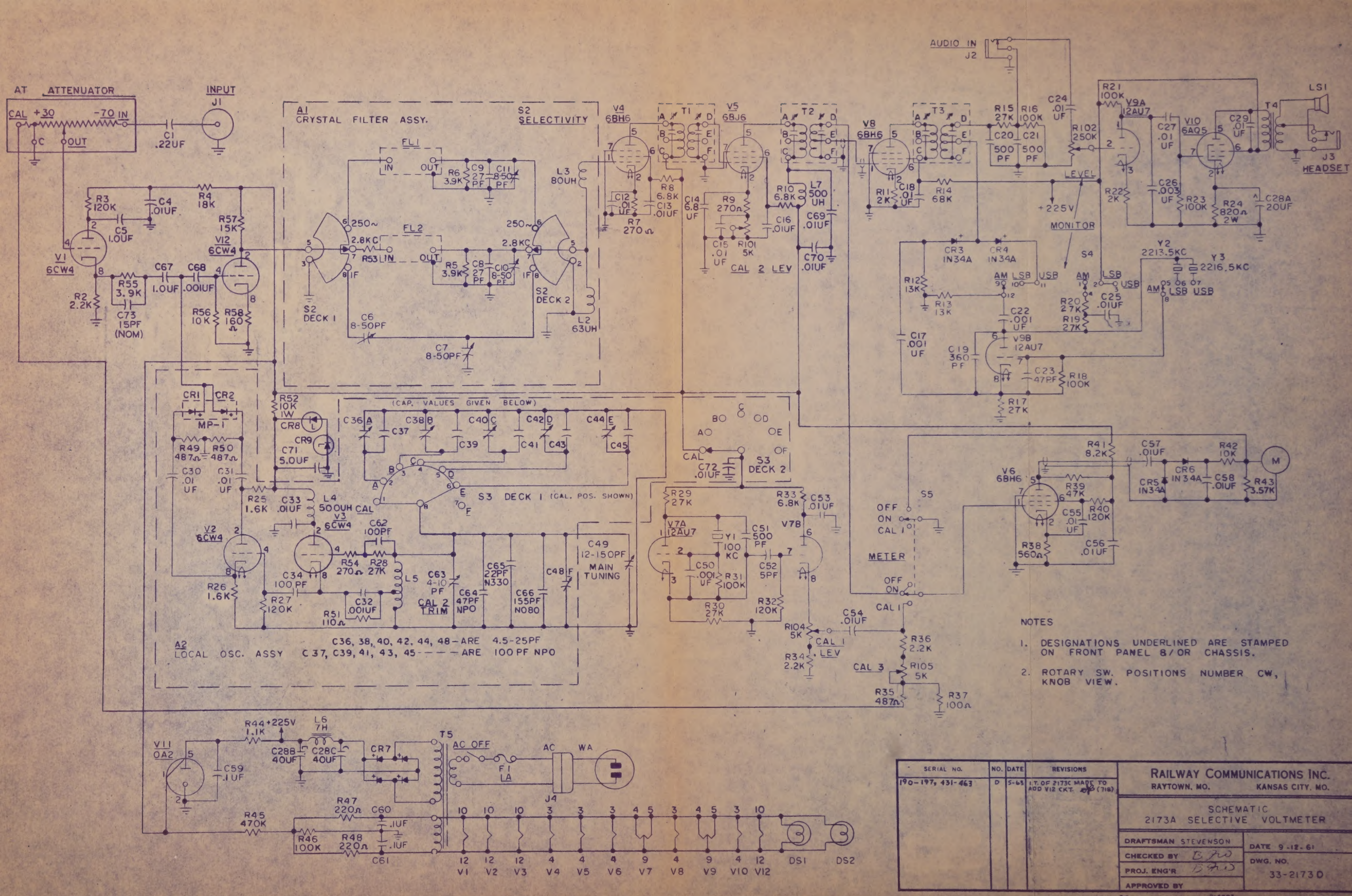
9351 E. 59TH STREET, RAYTOWN, MISSOURI
Phone: Code #816—FLeming 3-2100



NOTES

1. DESIGNATIONS UNDERLINED ARE STAMPED ON FRONT PANEL &/OR CHASSIS.
2. ROTARY SW. POSITIONS NUMBER CW, KNOB VIEW.

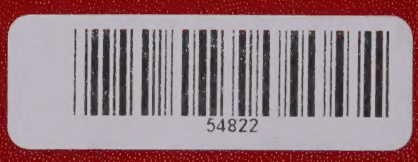
SERIAL NO.	NO.	DATE	REVISIONS
190-197, 431-463	D	5-63	I.T. OF 2173C MADE TO ADD V12 CKT. (718)

RAILWAY COMMUNICATIONS INC.
RAYTOWN, MO. KANSAS CITY, MO.

SCHEMATIC
2173A SELECTIVE VOLTMETER

DRAFTSMAN STEVENSON	DATE 9-12-61
CHECKED BY B Fro	DWG. NO. 33-2173 D
PROJ. ENG'R B Fro	
APPROVED BY	

T-R P-5005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